NebGuide

University of Nebraska–Lincoln Extension, Institute of Agriculture and Natural Resources

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G1475

Residential On-site Wastewater Treatment: Mound Systems

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The NebGuide is the result of a cooperative effort by the Nebraska On-site Wastewater Treatment Task Force, whose members are listed on the last page, and discusses how a mound system treats wastewater, why a homeowner might consider having one installed, advantages and disadvantages, and maintenance considerations.

Several areas in Nebraska are not appropriate for on-site wastewater treatment using conventional septic tank/drainfield systems. Mound systems are one of a number of alternative systems that have been developed to overcome site conditions that limit the use of a conventional drainfield, including soils with slow or fast permeability, shallow soils over bedrock or a high water table. A mound system creates suitable conditions for treatment above the natural soil surface. After preliminary treatment in a septic tank, effluent flows to a dosing chamber. Then it is pumped to the mound for further treatment and also uses the existing soil beneath the mound, where final treatment occurs and the water re-enters the environment.

How Does Treatment Occur?

There are three main components to a mound system: a septic tank or aerated tank, a dosing or pump chamber and the mound (*Figure 1*). Wastewater flows from the home to the septic tank where heavier materials settle to the bottom as sludge.

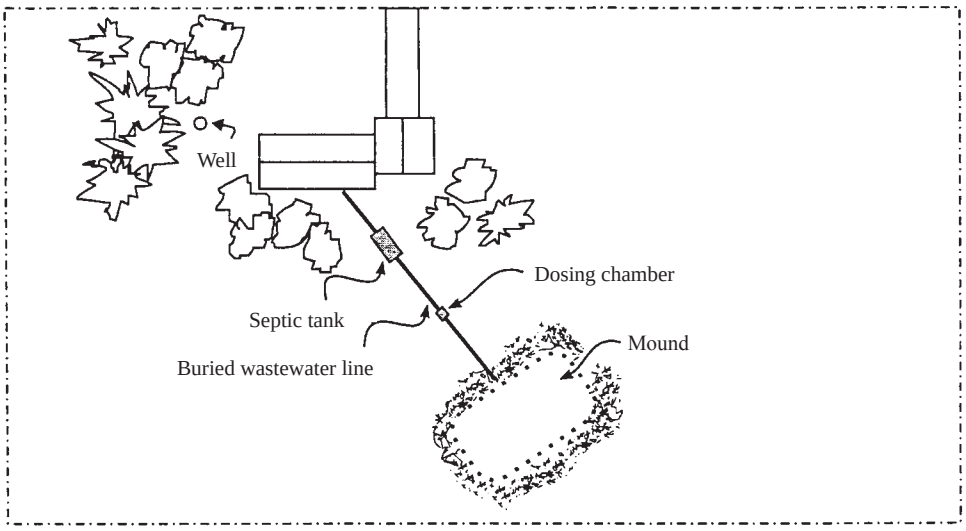

Figure 1. Mound system on a residential site.

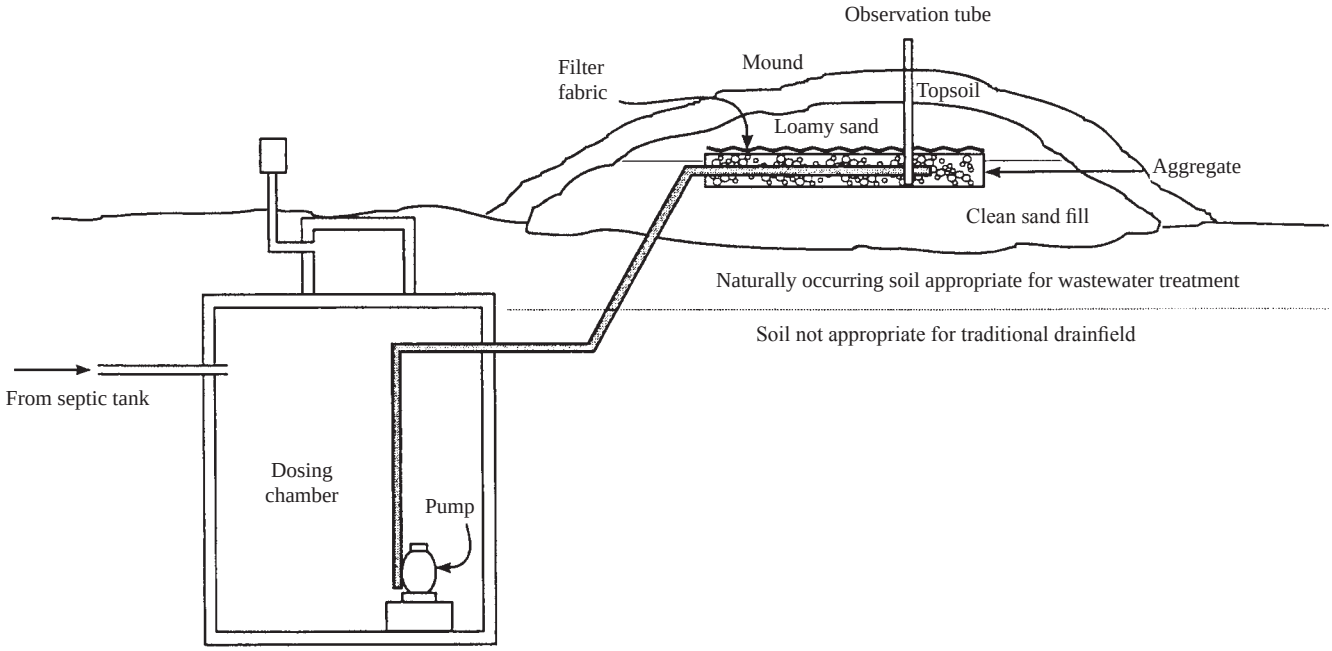

Figure 2. Side view of dosing chamber and mound.

Bacteria partially decompose this material. Lighter materials float to the top of the tank, forming a scum layer. The middle layer of wastewater, called septic tank effluent, flows to the dosing chamber, sometimes called the pump chamber.

The dosing chamber, made of concrete, fiberglass or plastic, collects the septic tank effluent. It contains a pump, pump control floats and a high-water alarm float. When the effluent rises to the "on" float position, the pump delivers effluent to the mound. Once a sufficient amount of effluent has been discharged, the level falls to the "off" float position and the pump stops. The control floats are adjustable so that a specific amount of effluent is pumped to the mound.

Many dosing chambers have an alarm float to warn of pump or other system problems. The float is set so that an alarm is triggered if the effluent rises above the "on" float level. The alarm, typically a buzzer and a light, should be wired to a circuit separate from that of the pump. The pump discharge pipe should have a quick disconnect coupler so that the pump can be easily removed for inspection, repair or replacement.

The mound *(Figure 2)* is a drainfield raised above the natural soil surface. It consists of a sand fill that contains a gravel-filled bed and network of small diameter pipes, called the distribution system. Effluent is pumped from the dosing chamber through the mound's distribution system in controlled, low-pressure doses. These doses distribute effluent evenly throughout the mound. Effluent flows out of the distribution system pipes through small holes and trickles through the gravel bed into a sand layer. Some treatment occurs in the sand layer; large particles are filtered from the wastewater, and some pathogens are destroyed. However, because wastewater travels through sand rapidly, more treatment is needed. There must be a layer of suitable naturally occurring soil beneath the mound that is thick enough to complete the treatment process. The soil filters out smaller particles, removing some chemicals and nutrients, and acts as a site for pathogens to be inactivated. There must be a cap of topsoil over the sand mound to shed rain, protect against frost and allow vegetative cover to grow.

What Are Advantages and Disadvantages of a Mound System?

One advantage of a mound system is that it often can be used on land that is not suitable for a traditional septic tank/drainfield system. Also, the mound system uses the top layer of naturally occurring soil, which is typically the most permeable. Since minimal excavation is required, construction damage to the site is minimized. Mounds can be used in most climates, and, with creative landscaping, can be attractive.

There are disadvantages to a mound system. Design and construction costs are typically much higher than those of conventional septic tank/drainfield systems. Mounds require a more highly skilled installer than is needed for a standard septic tank/drainfield system. Since there usually is limited permeable topsoil available at mound system sites, installers must be careful not to damage this layer. Mound placement may affect site drainage patterns and limit land use options. In addition, mounds are not suitable for steeply sloping sites. Mounds are difficult and often expensive to repair. Quality of construction materials (clean sand and gravel) is extremely important to the success or failure of the system. A mound system requires a pump instead of gravity to move wastewater through the system. If there is no power, the pump, and therefore the system, will not work and treatment will not occur. Lastly, mounds can be overloaded by high water use, resulting in repairs or, in extreme cases, replacement.

Permits

Factors such as mound location, size and shape; construction procedures; distribution of effluent; and dosing quantity all determine how well the mound will function. Each component must be properly designed by a professional engineer and constructed with good quality materials to reduce the possibility of premature failure of the system. The Nebraska Department of Environmental Quality (NDEQ) has no specific regulations on design and construction of mound systems. Instead, NDEQ engineers review each system design on a case-by-case basis. Documents consisting of a construction permit application, soils information, plans and specifications prepared by a Nebraska licensed professional engineer must be submitted to obtain a permit. A construction permit from NDEQ is required prior to construction of a mound system.

Mound Design and Sizing

An engineer must consider a number of factors when determining the size of a mound, including the number of bedrooms in the home, which dictates the wastewater flow rate to be used; the soil percolation rate of the top 12 inches of soil where the mound will be placed; the allowable loading rate (how many gallons of effluent per square foot the soil can absorb) of the soil; and the slope, among others. For example, a mound system for a three-bedroom home with a flow rate of 450 gallons per day (using tables based on number of bedrooms), a soil percolation rate of 20 minutes per inch, and a 2% slope would need a mound with a "footprint" approximately 45 feet wide and 70 feet long. This includes the area beneath the sloping sides. The mound could be smaller if the percolation rate was faster, the allowable loading rate was greater, there were fewer bedrooms or other factors were more favorable to effluent treatment.

Landscaping

The mound can be shaped in a variety of ways to suit individual landscaping and lot size needs. Properly landscaped areas around the mound can serve as a privacy barrier, a windbreak for homes and to screen unsightly views. Building a contoured mound works well for slightly sloping hillsides, while one built in the shape of a right angle can be placed on a corner. A rectangular mound is acceptable for uniform slope locations.

Vegetation will help to make the mound look attractive, as well as keep it intact. Do not plant or allow large trees, shrubs or plants with extensive root systems to grow within 20 feet of the mound because of the possibility of damage caused by roots. Low maintenance grasses or perennial flowers may be planted on the mound, with those that are resistant to water stress planted at the top, where the soil will tend to be dry. Wear gloves when landscaping and working around the system after it is in operation.

Maintenance

Septic Tank

Some maintenance of the septic tank, consisting of inspections and pumping, is required to prevent solids from entering the mound. Several factors determine tank-pumping frequency, including the number of people living in the home, wastewater generation rates and the amount of solids in wastewater, including whether a garbage disposal is used. Many experts recommend pumping a tank every 2 to 3 years. Depending on the factors listed above, a tank may need to be pumped more or less frequently. A safe approach is to have the tank inspected by a professional annually until pumping is required. Once the pumping interval is established, use that until there is a change in water use patterns. Additional people living in the home, children becoming teenagers, the installation of a garbage disposal, or the addition of a whirlpool tub all could increase water usage. Conversely, fewer people living in the home could decrease water use.

Septic Tank Effluent Filter

Due to the higher cost of a mound system, you may want to protect your investment and reduce the risk of failure by having an effluent filter installed at the outlet baffle of the septic tank. This filter captures larger particles that might otherwise flow to and clog the mound system. The effluent filter is cleaned when the tank is pumped, typically every few years.

Dosing Chamber

As with the septic tank, check the pumping chamber for sludge and scum buildup and pump as needed. Check the pump and floats annually for signs of wear and replace as necessary. Follow the manufacturer's recommendations for pump maintenance. Check electrical parts and conduits for corrosion and make sure the alarm is in working condition.

Mound

Maintain grass or vegetative cover to prevent erosion and also use some of the wastewater. If the mound has a lawn grass cover, mow it only two or three times a year. To reduce the chance of compaction, never mow grass on the mound if the soil is wet. Don't allow vehicular, animal or human traffic on the mound, as these also may compact soils. Consider fencing the mound area to keep pets or young children off the mound.

Summary

A mound system is an alternative to the traditional drainfield when the lot has slowly permeable soils, sandy or gravelly soils, or a high water table. A professional engineer must design the mound system, and a construction permit from NDEQ is required. The system includes a septic tank, pumping chamber and mound, all of which must be sized

according to potential wastewater generation from the home. This is determined by the number of bedrooms and whether the home has a whirlpool tub or other amenities that increase wastewater generation rates. A properly designed, installed and maintained mound system will protect human health and the environment.

Acknowledgments

Some information for this NebGuide was adapted from "Mounds: A Septic System Alternative" in Pipeline, Summer 1999, Volume 10, number 3, developed by the National Small Flows Clearinghouse (NFSC). Contact them for more information about on-site wastewater treatment systems by calling 800-624-8301 or visiting their site at http://www.nsfc.wvu.edu.

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